● PRINTER RUSH ● (PTO ASSISTANCE)

| Application : | 09/683988 | Examiner: _\ | Silvenag | GAU: | 1754 |
|---------------|----------------------------------|------------------------------------|---|--------------------------------|-----------------------------|
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| | ☐ SRFW ☐ DRW ☐ OATH ☐ 312 ☑ SPEC | | Other | | |
| [RUSH] MES | SAGE: All | tables throughout Please resent | t are extra | ingly smal n a nemal Tha | landvary font. nkyou. |
| [XRUSH] RES | SPONSE: | Correcte | allachn | ents | |
| | | | | | 110 |

NOTE: This form will be included as part of the official USPTO record, with the Response document coded as XRUSH.

REV 10/04

TABLE 1

| Solution | рН | Hydrogen Sulfide out, ppm (Time 5 minutes) |
|---|-------------|---|
| 1 Water | 5.4 | 400 |
| 2 + 2% Iron oxide | 4.8 | 210 |
| 3 + 2% Iron oxide | 4 .9 | 200 |
| 4 + 2% Iron oxide + 0.02% manganese oxide | 5.3 | 75 |
| 5 + 0.02% manganese oxide | 4 .0 | 400 |

TABLE 2

| | Reaction | Rate Constant |
|-------------------------|--------------------------------------|---|
| % Metal Oxide Activator | With Copper Oxide(Cu ₂ O) | With Manganese Oxide(MnO ₂) |
| 0 | 0.6 | 0.8 |
| 0.8 | 0.105 | 0.105 |
| 2.4 | 0.134 | 0.122 |

TABLE 3

| Reaction Rate Constant | | | | | | |
|-------------------------|--------------------------------------|---|--|--|--|--|
| | Reaction Rate Constant | | | | | |
| % Mctal Oxide Activator | With Copper Oxide(Cu ₂ O) | With Manganese Oxide(MnO ₂) | | | | |
| 0 | 0.10 | 0.10 | | | | |
| 8.0 | 0.158 | 0.133 | | | | |
| 3.0 | 0.184 | 0.154 | | | | |

TABLE 4

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| Product | Bad Life, Days |
|-------------------------------------|----------------|
| 100% Iron Oxide | 128 |
| 95% Iron Oxide + 5% Manganese Oxide | 144 |

TABLE 5

| Component | % by Weight Manganese Dioxide | % by Weight Manganese Dioxide/ Cuprous Oxide Activator | |
|---------------------|----------------------------------|--|--|
| Menthionlonite Clay | 64.1 | 63.6 | |
| MnO_2 | 24.3 | 24.1 | |
| Water | 11.6 | 11.5 | |
| CuO ₂ | 0.0 | 0.8 | |

TABLE 6

| Formulation | Bad Life, Days |
|---|----------------|
| Manganese Dioxide ziose | 29 |
| Manganese Oxide/Cuprous Oxide Activator | 4() |

TABLE 7

| Test Conditions | |
|---|--------------------|
| Temperature | 70° F. |
| Flow Rate of Natural Gas Containing II ₂ S | 5.41 liters/minute |
| Pressure | 0.5 psig |
| Bed Height | 7.9 feet (ft.) |

TABLE 8

| | Moderate II-S | Contamination | Extreme | II-S Contamin | ation |
|---|-----------------------------------|---------------------------------------|-----------------------------------|-------------------------------------|--------------------------------------|
| Gas Composition | II ₂ S No Oxygen | 500 ppm in II ₂ | II ₂ S Oxygen | | om in II ₂ volume |
| Test Results | Carbon Dioxide Iron Oxide Only | 14% by volume 1% by wt | Carbon Dioxide Iron Oxide Only | 14% by | volume r Oxide |
| Bed Depth for Complete H ₂ S Removal | Greater than 7.9 feet | Copper Oxide Less than 4.7 feet | Greater than 7.9 feet | 1.0% by wt Less than 2.7 feet | 0.25% by wt Less than 3.7 feet |

TABLE 9

| - | Iron Oxide with 1% by wt. Copper Oxide | | | | | |
|---|--|-------------------------|------------------|-----------------------------|-------------------------|-------------------------|
| | Iron Oxide O | nly | <u>At 4 ft</u> | . level | At 8 ft. l | evel |
| Hours in Test | At 4 ft. level H ₂ S | | H ₂ S | Total Mercaptans | H ₂ S | Total Mercaptans |
| At Start 6 Hr of Flow 21 Hr of Flow | 400 ppm* * | 0 ppm 0 ppm 0 ppm | | 0 ppm 35 ppm 40 ppm** | 0 ppm 0 ppm 0 ppm | 0 ppm 0 ppm 0 ppm |

^{*}The test was terminated due to the high amount of hydrogen sulfide, greater than 400 ppm, remaining in the headspace of the liquid hydrocarbon.
**Insignificant increase in mercaptan levels indicate maximum concentration has been

TABLE 10

| | Sample 1 | Sample 2 | Sample 3 |
|------------------------------------|----------|----------|----------|
| Inlet II ₂ S (ppm) | 25 | 22 | 24 |
| Inlet Mercaptans (ppm) | 20 | 20 | 20 |
| First Port II.S (ppm) | 0 | 0 | O |
| First Port Mercaptans (ppm) | 0 | 0.5 | 0.75 |
| Column 1 Temp (° F.) | 85 | 68 | 84 |
| Column 1 Press (psig) | 410 | 410 | 400 |
| Flow (ft ² /hr), actual | 30 | 30 | 30 |

reached.

TABLE 11

| | Sample 1 | Sample 2 | Sample 3 |
|---|----------|------------------------------|------------------------------|
| Inlet H ₂ S (ppm) | 25 | 22 | 24 |
| Inlet Mercaptans (ppm) | 20 | 20 | 20 |
| Inlet Carbonyl Sulfide | 0.025 | 0.025 | 0.025 |
| (ppm) | | | |
| First Part H ₂ S (ppm) | Ü | Broke through part 3 (15 ft) | Broke through part 3 (15 ft) |
| First Part Mercaptans (ppm) | 0 | Broke through part 3 (15 ft) | Broke through part 3 (15 ft) |
| First Part Carbonyl Solfide (ppm) | 0 | Broke through part 2 (10 ft) | Broke through part 3 (15 ft) |
| Column 1 Temp (° E) | 54 | 1 () | |
| Column 1 press (psig) Flow (ft ³ /hr) actual | 410 | | |

TABLE 12

| | | Mulch + 9% iron oxide | | | | | |
|----------------------|----------------------------------|-----------------------|------------------------|--------------------------|------------------------|-------------------------|------------------------|
| Mulch | | no additive | | +0.9% Cu ₂ () | | +0.09% MnO ₂ | |
| Con- tact sec. | [H ₂ S] out ppm | Contact sec. | [H ₂ S] out | Con- tact | [H ₂ S] out | Contact sec | [H ₂ S] out |
| 0 | 15 | 0 | 18 | 0 | 24 | 0 | 22 |
| 2.3 | 13 | 1 4 | 16 | 16 | 8 | 0 6 | 11 |
| 4 () | 12 | 2.7 | 1 1 | 27 | 1.8 | 14 | 5.2 |
| 8 1 | 13 | 4 0 | 7 | 4 0 | 0 9 | 2 7 | 4 3 |
| 13 1 | 12 | 8 1 | 2 1 | 5 4 | 10 | 8 1 | 14 |
| 33 2 | 10 | 16.1 | 0.7 | 8.1 16 1 | 1 () 0 | 16 1 | 0.3 |